
Three-phase oil-immersed distribution transformers 50 Hz, from 50 to 2500 kVA with highest voltage for equipment not exceeding 36 kV - Part 2: Distribution transformers with cable boxes on the high-voltage and/or low-voltage side - Section 2: Cable boxes type 1 for use on distribution transformers meeting the requirements of HD 428.2.1 S1

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**Three-phase oil-immersed distribution transformers 50 Hz,
from 50 to 2500 kVA with highest voltage for equipment
not exceeding 36 kV**

**Part 2: Distribution transformers with cable boxes on the
high-voltage and/or low-voltage side**

**Section 2: Cable boxes type 1 for use on distribution transformers
meeting the requirements of HD 428.2.1 S1**

Transformateurs triphasés de
distribution immergés dans l'huile 50 Hz
de 50 à 2500 kVA de tension la plus
élevée pour le matériel ne dépassant pas
36 kV

Partie 2: Transformateurs de distribution
avec des boîtes à câbles moyenne
tension et/ou basse tension

Section 2: Boîtes à câbles de type 1
pour utilisation sur transformateurs de
distribution conformes aux exigences du
HD 428.2.1 S1

Drehstrom-Öl-Verteilungs-
transformatoren 50 Hz, 50 bis
2500 kVA, mit einer höchsten
Spannung für Betriebsmittel bis 36 kV
Teil 2: Verteilungstransformatoren mit
Kabelanschlußkästen auf der Ober-
und/oder Unterspannungsseite
Hauptabschnitt 2: Kabelanschlußkästen
Typ 1 für Verteilungstransformatoren
nach HD 428.2.1 S1

This Harmonization Document was approved by CENELEC on 1996-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for implementation of this Harmonization Document on a national level.

Up-to-date lists and bibliographical references concerning such national implementation may be obtained on application to the Central Secretariat or to any CENELEC member.

This Harmonization Document exists in three official versions (English, French, German).

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

This Harmonization Document was prepared by the Technical Committee CENELEC TC 14, Power transformers.

The text of the draft was submitted to the formal vote and was approved by CENELEC as HD 428.2.2 S1 on 1996-10-01.

The following dates were fixed:

- latest date by which the existence of the HD has to be announced at national level (doa) 1997-03-01
 - latest date by which the HD has to be implemented at national level by publication of a harmonized national standard or by endorsement (dop) 1997-12-01
 - latest date by which the national standards conflicting with the HD have to be withdrawn (dow) 1997-12-01
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1 Scope

This document specifies the requirements for cable boxes, Type 1, in which the cable cores are terminated. The cable boxes are suitable for use on transformers defined in HD 428.2.1 S1, Distribution transformers with cable boxes, for side mounted or cover mounted use. The cable boxes are suitable for operation indoors and outdoors under environmental conditions specified in HD 428.1 S1. Important design and construction requirements of the cable boxes are given.

2 Normative references

This Harmonization Document incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this Harmonization Document only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 50180	1997	Bushings above 1 kV up to 36 kV and from 250 A to 3,15 kA for liquid filled transformers
EN 60076 HD 398	series	Power transformers (IEC 76 series, modified)
HD 428.1 S1	1992	Three-phase oil-immersed distribution transformers 50 Hz, from 50 to 2500 kVA with highest voltage for equipment not exceeding 36 kV - Part 1: General requirements and requirements for transformers with highest voltage for equipment not exceeding 24 kV
HD 428.2.1 S1	1994	Part 2: Distribution transformers with cable boxes on the high-voltage and/or low-voltage side - Section 1: General requirements
HD 506 S1 + A1	1989 1992	Bushings for liquid filled transformers above 1 kV up to 36 kV
HD 607 S1	1996	Busbar bushings up to 1 kV and from 1,25 kA to 5 kA, for liquid filled transformers

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3 Definitions

For the purpose of this document the following definitions apply:

3.1 fully insulated cable box

A metallic cable box where those parts of the termination and bushing within the enclosure including live metal parts and cable cores are insulated by oil or compound suitable for the appropriate system voltage.

3.2 air filled cable box

A metallic cable box designed to protect the ends of the cables and bushings, providing a weatherproof enclosure with a minimum rating of IP54.

3.2.1 air insulated termination

An air filled cable box within which the cable cores are electrically terminated by stress control appropriate to the cable design and voltage; air being the sole insulation for the terminal connections.

3.2.2 shrouded insulation termination

An air filled cable box within which the cable cores are terminated as in 3.2.1 with additional local insulation enhancement, e.g. bushing protection, taping.

NOTE: Enhancement can be achieved by using insulated phase barriers, however, in this case full creepage distance air bushings are used.

4 Electrical requirements and clearances

4.1 General

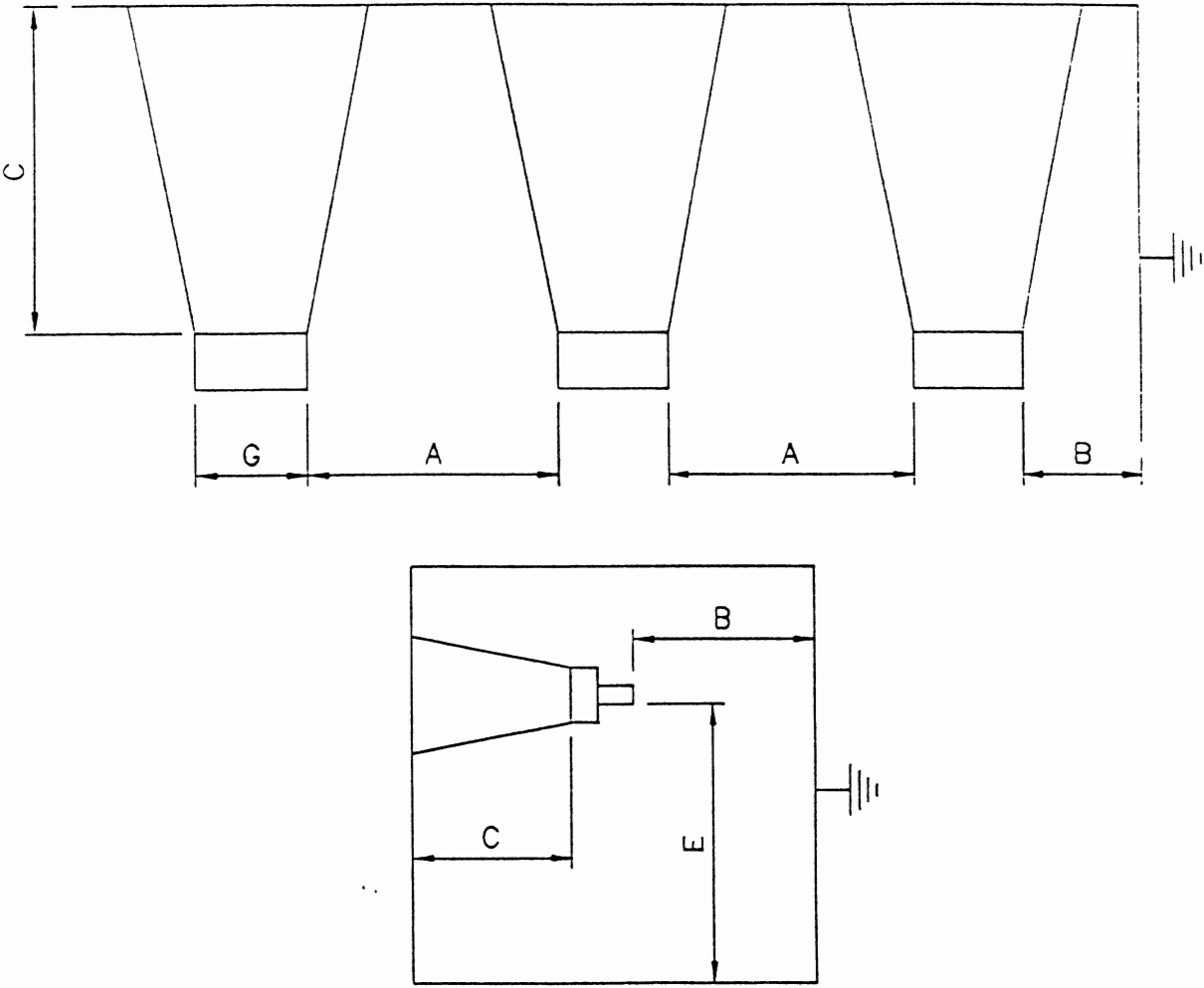
The enclosures when in position on the equipment with which they are to be used shall be capable of withstanding the high voltage tests specified in HD 428.1 S1 as well as commissioning tests to be carried out on the connected cable.

4.2 High voltage enclosures

The rated voltage of a box is the highest voltage designated for the equipment and preferred values in use are given in table 1.

Table 1 defines the minimum clearances required between live metal parts, and between live metal parts to earth, and insulator creepage requirements. The fixing flange types are as given in HD 428.2.1 S1, figure 1. However, shorter clearances may be agreed subject to confirmation by test.

Bushings suitable for use in high voltage enclosures are specified in document EN 50180. Other bushings can be used if agreed between manufacturer and purchaser provided the minimum limiting dimensions of table 1 are complied with.



Dimension G: see EN 50180

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Figure 1: Clearance distances

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Table 1: Three phase cable box, type 1

(Dimensions below in mm)

Air insulation													
kV	LIST I						LIST II						
	BIL	A	B	C	E		BIL	A	B	C		E	
	kVp				Single	3 Core	kVp			Min.	Max.	Single	3 Core
12	60	90	90	125	495	585	75	120	120	125	200	495	585
24	95	160	160	224	575	685	125	200	200	205	305	575	685
36	145	270	270	309	625	880	170	320	320	325	380	625	880

Fully insulated oil/compound filled

LIST II						
kV	BIL	A	B	C	E	
	kVp				Single	3 Core
12	75	45	32	50	495	585
24	125	100	75	90	575	685
36	170	125	100	135	625	880

Shrouded

LIST II						
kV	BIL	A	B	C	E	
	kVp				Single	3 Core
12	75	55	50	80	495	585
24	125	110	100	140	575	685
36	170	165	150	225	625	880

NOTE: The above clearance dimensions are minima. The design of enclosure should take account of the actual manufacturer's dimensions for the terminals to ensure that all clearances are complied with. The distances given in the table are consistent with the minimum clearances necessary; the currently available bushings, however, as described in EN 50180 have distances, especially C, in excess of those given in the table. This fact should be taken into account when sizing the cable box.

- List I distances are for use with shedded bushings.
- The clearances given assume that the cable termination connected to the bushing cap does not reduce the clearance dimension.
- Air insulation list II - C values. Minimum values are based on BS practice and experience. Maximum values are in line with HD 506 S1/A1.
- For voltage levels below 12 kV the dimensions A, B, C and E are subject to agreement between manufacturer and purchaser.
- For application of list I and list II, see HD 398.3 S1.

Cables above 185 mm² should not be crossed in boxes with E dimensions equal to those given. The E dimension can be extended to a dimension agreed between manufacturer and purchaser when crossed cables are required.

4.3 Low voltage boxes

All low voltage boxes shall be capable of accepting either bushings or monobloc or single bloc busbar type terminations of the correct rating for the maximum current required from the transformer. The box flange is as given in HD 428.2.1 S1, figure 1.

Due consideration shall be given to the effects of electromagnetic induced losses caused by high currents.

On agreement between purchaser and manufacturer, the flange types can be different to those given.

Terminations suitable for use in LV cable boxes are specified in EN 50180 and HD 607 S1.

5 Design considerations

5.1 The boxes shall be selfcontained. The bushing mounting plate is an integral part of the enclosure for HV boxes. Cast iron shall not be used.

Fully insulated cable boxes shall be suitably sealed to contain the oil or compound and allowance made for thermal expansion.

Ventilation measures are to be provided in the case of air filled boxes of IP 54 protection. Means of draining air filled boxes are to be provided. Filling measures are to be provided in the case of oil/compound filled boxes and due consideration made to the filling medium expansion due to temperature changes.

5.2 Terminal nuts and stems

The dimensions of terminal nuts and stems are related to the bushings in use for the appropriate currents and are given in relevant standards.

5.3 Provision for glanding cables

NOTE: Under consideration in TC 20.

5.4 Termination of cables within enclosure

To allow for termination of cables, the minimum vertical distance from the surface of the bushing cap to the gland plate shall be as given in figure 1. The dimension E allows for only uncrossed cables at above 185 mm².

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